CYCLONES AND ANTICYCLONES.

By W. P. DAY.

About half of the low-pressure areas were of the Alberta type with centers of minimum pressure north of the Canadian border. The really important storms of the month were two from the North Pacific and a secondary development over central districts.

HIGHS were mostly of North Pacific origin and were not important factors in temperature control. The only Alberta HIGH of the month appeared in the northwest about the 29th and was responsible for the only important temperature reduction. In fact, the character and movement of the high and low pressure areas were about as would be expected considering the abnormal warmth which prevailed over most sections.

FREE-AIR SUMMARY.

By L. T. SAMUELS, Meteorologist.

The abnormally high mean temperatures, particularly at the northern aerological stations, present the most striking feature of the free-air conditions for the month. (See Table 1.) An intense cold wave occurred at the close of the month reaching Ellendale late on the 28th, Drexel on the 29th, Broken Arrow early, and Groesbeck late, on the 30th. The severity of this cold wave appreciably affected the monthly means and to exclude its influence at Ellendale, for example, would be to increase the monthly mean 2° C. When this is taken into consideration it is even more clearly seen how exceptionally warm the greater part of the month was. In general, at the northern stations the departures decreased with increase in altitude while at the southern stations the reverse was true.

Relative humidity departures were mostly negative at those stations having large positive temperature departures, being small at practically all stations except Groesbeck where they were considerably above normal for all levels.

Vapor pressures were mostly above normal except at Ellendale where an appreciable deficiency in the monthly precipitation occurred. At Groesbeck the reverse condition was found, vapor pressures being unusually high considering the average temperatures at this station, while a great excess of precipitation fell during the month.

The resultant winds as shown in Table 2 did not differ essentially from their normals, the largest variations being found at Drexel and Due West, where the monthly values contain either a more southerly or less northerly component and at Groesbeck a smaller southerly component than normally. This is in harmony with the average temperatures found at these stations.

Pilot-balloon observations from 13 stations east of the Rocky Mountains show the resultant winds at the surface for the month to have been from a southerly quarter except at Ellendale. A north component becomes dominant, however, at stations to the southward with increasing elevation so that at 4,000 m. all of the stations, including Key West, have a north component.

An unusual turning of the wind with altitude occurred over the Plains States on the 4th. The map of this date shows a LOW of wide extent central over the lower Mississippi Valley and high pressures to the westward with another disturbance approaching from the northwest. Both morning and afternoon pilot-balloon observations at Ellendale and Drexel showed northeast winds above 3,000 m., continuing to at least the level of the stratosphere. As a rule upper easterly winds are not of very great velocity but in this case a steady increase occurred, reaching 40 m. p. s. (90 m. p. h.), at the highest levels. It is noted that by the following day the Mississippi LOW had greatly increased in intensity and it seems probable, therefore, that the upper northeasterly winds at Ellendale and Drexel were part of this cyclonic circulation.

On the next day (5th) an unusual temperature distribution prevailed over the middle of the country when a strong temperature inversion at Ellendale caused a rise of 14°C. from the surface to 350 m. altitude. Above this, the temperatures continued higher at this station than at those to the southward, as far as Groesbeck. This condition extended to unusually high altitudes and at the highest point reached by the kites the temperatures at Ellendale continued 5°C. higher than at Broken Arrow. The following table shows the temperatures and wind directions observed this date.

Altitude, M. S. L. meters.

Stations.	Time.	Surface.	250	500	750	1,000	1,250	1,500	2,000	2,500	3,000	3,500	4,000	4,500
		Wind directions and temperatures (°C.).												
Ellendale	8 a. m.	SSW. −5.5	.....	SSW. −3.2	SSW. 7.0	SW. 7.9	SW. 7.2	WSW. 6.5	W. 4.4	WNW. 1.5	NW. −1.6	NW. −5.1	NW. −8.5	.....
Drexel	6 p. m.	S. 1.6	.....	S. 2.8	S. 1.8	SW. 3.2	WSW. 2.6	W. 1.3	WNW. −1.3	WNW. −1.7	.....	.....	.....	.....
Broken Arrow	9 a. m.	N. 1.5	N. 1.4	N. −0.3	NNW. −2.0	NNW. −3.1	N. −1.6	N. −2.4	NNW. −4.1	NNW. −5.3	NNW. −7.7	NNW. −10.1	.....	.....
Groesbeck	8 a. m.	NW. 4.3	NW. 4.5	NW. 4.9	NW. 4.3	NW. 2.7	NW. 1.1	NW. 0.8	NW. −1.0	NW. −3.5	NW. −5.8	NW. −6.5	NW. −8.7	..... −10.9

For the explanation of such a reversal of the normal temperature gradient we inquire first as to the source of the imported air. It is found that on this morning Ellendale was in the southern quadrant of a strong LOW with SSW. winds at the surface, veering to WNW. at 2,000 m. and backing to WSW. at 6,000 m. That the air brought in over the northern stations was relatively warm is conclusively shown in the above table. The high temperatures at Ellendale did not continue long as is shown by a "series" of continuous kite flight made here on this date. The rapid eastward movement of this LOW caused the winds here soon to shift to NW. at all levels and the free-air temperatures fell steadily throughout the day. The flight at Drexel was not made until evening and so is not comparable in view of the rapid movement of the pressure areas. Flights at Broken Arrow and Groesbeck, however, made at the same time as at Ellendale, were under the influence of the LOW central over the Ohio Valley and winds were mostly N. at all levels.

During the period 16–18, inclusive, there occurred over the interior of the country easterly winds extending to 5,000 m. and higher. These are shown in the following table.